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ABSTRACT

In the first of four symposium papers, Clark reviews the research on learning from media and uses his argument that media comparison studies show no differences in learning attributable to any one medium over another to dispute recent research on computer-assisted instruction. He also takes the position that the media attribute argument (i.e., different media contribute to learning by providing attributes that cultivate cognitive skills) is not supported by cognitive research. While the psychological contributions of media are disputed, the economic benefits of the utilization of instructional media are recognized, and a recent study on the cost-effectiveness of media is described. Social and political barriers to media implementation are identified as areas in which further research is needed, and the confusion and conflict between an older craft-oriented approach to media and newer scientifically-based technologies is discussed. The paper concludes with the suggestion that media researchers need to orient themselves much more towards the social science disciplines. Ten references are listed. (MES)

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Title:

Which Technology for What Purpose?: The State of the Argument About Research on Learning from Media

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WHICH TECHNOLOGY FOR WHAT PURPOSE?:

The State of the Argument About Research on Learning from Media

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Symposium paper for presentation at the annual convention of the Association for Educational Communication and Technology, Atlanta Georgia, Thursday, February 26, 1987.

Arguments that media do not influence learning have a very long but largely ignored history. Over sixty years ago, Freeman (who is quoted in Saettler's history of educational technology), cautioned against media comparison studies. In the years since, his advice has been elaborated on by researchers such as Wilbur Schramm, Pat Suppies, Kieth Mielke, Howard Levie and Gavriel Salomon. My own contribution to the argument has been minor. When one considers the weight of evidence against media comparisons, one quickly comes to the conclusion that the continuing argument indicates a considerable resistance to the evidence. I reasoned that the problem was not in the research reviews but in the communication between researchers and practitioners. My small contribution was to provide what I hoped were meaningful and accurate analogies (e.g. the grocery truck and nutrition analogy plus the inert medium for drugs and body chemistry analogy). I also avoided the "tentativeness" one typically finds in the reviews of responsible researchers. It seemed to me then (and now) that media enthusiasts interpreted our cautious writing style as the sign of a weak argument. Therefore, I used more active prose to suggest that "...media do not influence learning under any conditions." (1983, p. 445).

As might be expected, there is still considerable resistance to this reasonable interpretation of sixty years of research. One measure of the resistance is to be found in my mail over the past five years. I have received a surprising volume of letters charging me with providing support and comfort to the enemies of media in education and training. More important is the fact that some people mistakenly believe that I have a dispute with Jim Kulik and his colleagues at the University of Michigan about meta-analytic techniques. Equally important is the impression that I am somehow "against" media. I'd like to use this fairly informal Proceedings format to dispel all three misconceptions.

A Brief Restatement of the Media and Learning Argument. Basically I have made two arguments: first, that media comparison studies show no differences in learning attributable to any one

medium over another; and second, that the so-called media attribute argument is not supported by current cognitive research.

The first argument that media comparison studies are usually confounded is rarely disputed by people who have specialized in media research. This confounding shows up in many ways. One of the most dramatic can be found in the current meta-analyses of CBT research. The clue to the confounding in research can be found in studies where the same teacher or designer produces both the computer and the "traditional" treatment. The effect size in these studies is usually smaller. I have argued that there is compelling evidence that this smaller effect is due to increased chances that the same content and method will be used in both the traditional and the CBT presentations -- which leads to no statistical difference in the learning between the two types treatments. Of course this control is not automatic. Some of the "same teacher" studies have poor controls just as studies where treatments were designed by different groups sometimes have good controls. In a recent survey of a 30% sample of the college CBT studies meta analyzed by Kulik and his colleagues, I separated well controlled from poorly controlled studies (Clark, 1985a, 1986). The effect size in well-controlled studies fell to .09 standard deviations in favor of CBT. This low effect size, I suggested, would be even lower if low ability learners had received more practice using computers before studies started. More recently, Levin (1986) has provided a similar meta-analysis ~~adequate~~ of CBT cost-effectiveness research. He finds CBT effect sizes ranging from .12 for mathematics to .24 for reading -- which is within the range of my analysis. Levin and I have estimated effects considerably lower than the .4 to .5 effect sizes reported by Kulik and his colleagues. The difference between the research Levin and I have analyzed and the studies used by Kulik is simply a different set of criteria for control. Kulik is correct in his claim that there is a very powerful set of instructional methods used in the development of CBT. I would like to have us examine those methods separately from their confounded attachment to the medium of Computers.

While Kulik and I had some early discussions about our separate findings, we have since agreed -- as Kulik et al nicely put it -- that in comparison studies there is a "...diffusion of the innovative treatment to the control condition.", (1985, p. 385). In more direct terms, we agree that there are uncontrolled content and instructional methods in many computer-based training and "control" treatments which account for learning gains. These methods can "diffuse" or be delivered by live teachers or older, more traditional media. I have urged researchers and practitioners to focus on an explication of these instructional methods if we wish to understand what causes the large effect sizes one finds in CBT studies (Clark, 1985b)

Media Attribute Research. The argument about the media attribute theories is not so easy to dismiss. I have disputed the

theory that different media contribute to learning by providing "attributes" that cultivate cognitive skills. For example, in one of Gavriel Salomon's well-known studies, "zooming" into details cultivated the skill of "cue attendance" for low ability students. While Salomon has clearly noted that these attributes are not specific to any one medium, his theory has mistakenly been associated with the argument about the "contribution" of media to learning. Salomon and I reviewed the evidence in our recent Handbook chapter (1986) and noted that the dispute is part of a much wider argument between two factions in cognitive psychology. I have noted that no one has ever established that any attribute which is specific to one medium or class of media is "necessary" to learn any specific cognitive skill (Clark, 1983). Whenever one finds an attribute -- such as zooming into details or rotating visual forms or ways to depict three dimensions -- it will always be the case that other, different attributes or presentation forms will teach the same cognitive skill. If this claim is correct, then one must conclude that media attributes are interchangeable and make no necessary psychological contribution to learning.

Remaining Disputes

Media Attributes. Of course, there are still grounds for reasonable dispute about media attribute theories. Bob Kozma, at the University of Michigan, has provided a summary of an alternative point of view in a recent ECTJ article (Kozma, 1986). He ~~Kozma~~ notes that specific media attributes do not have to be necessary to be important for learning -- a reasonable point. Yet he still argues that some media might have unique "mixes" of attributes and therefore be "powerful" and make a "unique" contribution to learning. This seems to me to beg the question but I'm eager for Kozma to be more specific about which mix and what medium. He and I have been collaborating on the development of this argument and are committed to continue to work together until we have resolved the problem.

Is Media Useful in Education and Training? The remaining issue is much more emotional and less tangible. If one reaches the conclusion that media make no necessary psychological contribution to learning outcomes, can one then support the use of media in education and training? The answer to this question is, I think, a very enthusiastic "yes". My research has been directed to dispelling misconceptions about the psychological contribution of media. On a different level, there is considerable evidence that the benefits to be derived from media are primarily economic. That is, different types of media have the potential of saving a significant amount of instructional development, learning and delivery time and money. Economic savings are available both in large instructional systems and on a more personal level to the writer and researcher.

Media also have the potential to greatly increase the

reliability or consistency of instructional technology. The direct benefit to psychological research are also obvious to most of our colleagues. Various delivery media have been used as productive analogies of human perception and thinking. The computer serves as the model of the human learner which dominates the new and exciting cognitive psychology. The medium of Laser Holography has helped Carl Pribram at Stanford understand the mysterious capacity of the brain to distribute long-term memory store throughout the brain and make it more or less impervious to erasure. While media will continue to serve as analogies of human cognitive and perceptual processes, the most productive future research will probably deal with efficiency questions.

Recent Studies of the Economic Benefits of Media. While there have been many recent studies of the economic benefits and pitfalls of media, one of the most thorough and important is the recent, yet unpublished review by Henry Levin at Stanford University (November, 1986). He has reanalyzed a number of recent, comprehensive CBT cost-effectiveness studies. His conclusions, presented only briefly here, note that CBT cost-effectiveness (C/E) is relatively poor in most evaluation studies. However, when sites make a determined effort to promote full utilization of the medium and the software, C/E increases by a factor of 50 percent. Most important for media managers is Levin's finding that there are dramatic C/E differences for the came CBT programs between implementation sites. That is, when the same CBT program is implemented in different schools or cities, the C/E ratio changes by as much as 400 percent! This strongly suggests the importance of management systems for implementing and directing the use of CBT systems. Levin's study also provides many important cautions for the researcher and the practitioner communities. To date he has located about 80 large-scale CBT evaluation studies where costs and time were assessed. Yet, his attempt to include only adequate studies in his analyses excluded all but eight from his final analysis. It seems that we should be wary of basing research or implementation decisions on any arbitrarily selected subset of this flawed literature. Levin's description of what he calls the CBT "implementation" issue should be required reading for all media researchers. He notes, for example, that elementary school computer systems tend to be more fully utilized than those in secondary or college settings -- which may account for the typically larger achievement effect sizes found in the meta-analyses by Kulik and others.

We should, I think, welcome the increased media research collaboration of outstanding economists such as Levin. It seems that the practical payoff available to education and training from media is primarily economic and administrative. If we can encourage more rigorous cost-effectiveness research, we will know better how to make the best use of newer systems.

The Social and Political Context of Media Use. Of course,

even when we find the most efficient way to deliver instruction in various settings there will always be barriers to implementation. In this regard I have been influenced by the scholarship of Bob Heinich at Indiana University (1985). Heinich cautions us that education is a "labor intensive" activity which is dominated by powerful teachers unions. He recommends increased research interest on questions dealing with the social and political barriers to media implementation. In the context of Levin's cautions about "full implementation", Heinich seems to be pointing to a potentially significant barrier which needs to be understood better. What is desperately needed here is objective and scholarly studies of the social and political context of change in the delivery of instruction. We have ample examples of polemics about "teacher resistance" and "Luddite" thinking in reference to media. The cause of the conflict may stem from an impending revolution in our profession.

A Confusion of Technologies. One basic problem in our past thinking about media seems to me to have been a confusion about which technology was serving what purpose. Heinich's (1985) reminder that technology is best interpreted as the "application of a science" to solving practical problems is a critical point. In our field we too often mean "machine" when we use the term technology. Actually, the machines we call media are the result of communication technology i.e. they are the consequence of the sciences dedicated to describing the transportation of information. One of the eldest and closest scientific relatives of communication science is economics. Information theory was the offspring of a marriage between "Ma Bell" and a few crusty mathematicians. Essentially, it had its origin in the search for more efficient ways to send more signals with greater fidelity over fewer telephone cables. One resulting technology called media solves problems related to the efficiency of transporting or "delivering" information (this is the origin of the grocery truck and nutrition analogy). However, delivery technology does not solve psychological problems. The "science" of psychology is applied in the technology of instructional design. Here we deal with issues of, for example, the psychological consequences of different task, individual difference and instructional method variables. When we confuse the two technologies and, by extension, their underlying sciences -- we design confounded research.

CONCLUSION

A Confusion of Craft with Technology. The final point to be raised in this paper seems to me to be the most important of all. The origin of the resistance to media research and the confusion of technologies is part of a larger and more serious dispute in our field. The real conflict is between an older "craft" oriented approach to media and newer scientifically-based technologies. The craft approach typifies much of teacher education and practice, some of the media enthusiasms, and (sadly) even a few of our university departments and professors of "educational

communications, systems and technology". The differences between the two approaches are profound and the decision about which point of view will dominate may be the most important determiner of the future of our field (Clark, 1987).

Craft approaches are based on the assumption that problems can be solved with procedures which have evolved over time as a result of "expert" experience. When a craft dominates a teaching activity, the curriculum consists of procedures which are suspected to have solved problems in the past. Yet, these procedures seldom are applicable to future problems and a craft cannot easily adjust to changes. John Dewey's attraction to science as a way of solving educational problems stemmed from his concern about our failure to provide educators with effective and flexible strategies for teaching. As a result, he wrote, the teacher must "...fall back upon mere routine traditions of school teaching, or to fly to the latest fad [or] panacea peddled out in school journals or teacher's institutes -- just as the old physician relied upon his magic formula." (Dewey, 1900, p. 113). There are simply too many "magic formula's" around today in the media area. Too many unfounded assumptions and procedures for guiding instructional design and delivery. Many of these assumptions are demonstrably wrong but since there is little attempt at objectivity, the same mistakes are repeated over and over without correction. It is the nature of a craft to notice what fits our expectations and ignore what does not. This strategy seems to maintain our self esteem in unimportant personal matters but it makes a mess of our professional contributions.

Barbara Ward, the great historian and sociologist, has warned that the difference between craft and science-based technology is as profound as the most fundamental difference between primitive and advanced societies. The backward dependence on craft when technologies are available is, I think, one of the most important roots of the difficulties being experienced in the past few years by AECT. The commitment to research and researchers in this organization has always been tentative and reluctant. Enthusiasm for the newest media fad and panacea has been the dominant theme of this organization for the two decades that I have followed its activities. People with a strong commitment to and training in research have seldom held responsible positions in AECT. When they do they typically report a considerable lack of interest on the part of many powerful members to support a research focus for the entire organization. One current consequence of this attitude has been the recent failure to support our research journal, ECTJ, even though it has always made more money than it costs to publish.

While I am reluctant to suggest a solution to AECT's problems, I do think that media researchers need to orient themselves much more towards their "parent" social science disciplines. We can not continue to conduct our research with the same set of values which have driven the media enthusiasms of the past. If one is interested

in instructional design for computer-based training for example, then it is imperative to master and follow the research and theory developments in instructional psychology. Specialists in media delivery should monitor relevant economics and organizational research. Those interested in the types of problems raised by Bob Heinich should make a commitment to master research in sociology, social-psychology and/or political science. What will connect us all is a common thread of scientific methodology, a commitment to developing a "linking science" (as Dewey suggested), and an abiding interest in contributing to the future development of instructional research, theory and practice.

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